this occasion with only a brief reference to infection from the milk and flesh of tuberculous cattle.

It has been abundantly demonstrated by numerous experiments that the milk from tuberculous cows is capable, when ingested, of causing tuberculosis. How serious is this danger may be seen from the statistics of Bollinger, who found, with cows affected with extensive tuberculosis, the milk infectious in eighty per cent of the cases; in cows with moderate tuberculosis, the milk infectious in sixty-six per cent of the cases; and in cows with slight tuberculosis, the milk infectious in thirty-three per cent of the cases. Dilution of the infected milk with other milk or with water diminished, or in sufficient degree removed, the danger of infection. Bollinger estimates that at least five per cent of the cows are tuberculous. From statistics furnished me by Mr. A. W. Clement, V.S., it appears that the number of tuberculous cows in Baltimore which are slaughtered is not less than three to four per cent. Among some breeds of cattle, tuberculosis is known to be much more prevalent than this.

There is no evidence that the meat of tuberculous cattle contains tubercle bacilli in sufficient number to convey infection, unless it be very exceptionally. Nevertheless one will not willingly consume meat from an animal known to be tuberculous. This instinctive repugnance, as well as the possibility of post-mortem infection of the meat in dressing the animal, seems to be good ground for discarding such meat. The question, however, as to the rejection of meat of tuberculous animals, has important economic bearings, and has not been entirely settled. As to the rejection of the milk from such animals, however, there can be no difference of opinion, although this is a point not easily controlled.

The practical measures to adopt in order to avoid infection from the food, are, for the most part, sufficiently obvious; still it is not to be expected that every possibility of infection from this source will be avoided. It is difficult to discuss the matters considered in this address without seeming to pose as an alarmist; but it is the superficial and half knowledge of these subjects which is most likely to exaggerate the dangers. While one will not, under ordinary circumstances, refrain from eating raw fruit or food which has not been thoroughly sterilized, or from using unboiled or natural waters in the fear that he may swallow typhoid or cholera bacteria, still, in a locality infected with cholera or typhoid-fever, he will, if wise, not allow himself the same freedom in these respects. Cow's milk, unless its source can be carefully controlled, should, when used as an habitual article of diet, as with infants, be boiled, or the mixed milk of a number of cows should be selected; but this latter precaution offers less protection than the former.

In most places in this country we are sadly lacking in good sanitary inspection of the food, especially of the animal food, offered for sale. One cannot visit the slaughter-house in Berlin or in Munich (and doubtless similar ones are to be found elsewhere), and watch the intelligent and skilled inspection of the slaughtered animals, without being impressed with our deficiency in this respect. In large cities an essential condition for the efficient sanitary inspection of animal food is that there should be only a few places, and preferably only one place, where animals are permitted to be slaughtered. Skilled veterinarians should be selected for much of the work of inspection.

It may reasonably be asked that the national government, which has already spent so much money for the extermination of such diseases as pleuro-pneumonia of cattle and hog-cholera, which are not known to endanger the health of mankind, should turn its energies also to means for eradicating tuberculosis from cattle, which is a scourge not only to the economic interests of farmers and dairymen, but also to the health of human beings.

Without any pretension to having done more in this address than to sketch here and there a few principles derived from bacteriological researches concerning only some of the most widely distributed external sources of infection, I trust that enough has been said to show the folly of any exclusive dogma as to modes of infection. The ways of infection even in one and the same disease are manifold and various, and can never be resolved into exclusive hypotheses, such as the drinking-water hypothesis, the ground hypothesis, etc.

It follows, therefore, that it is not by sanitary improvements in one direction only that we can control the spread of preventable epidemic diseases. In one situation improvements in the supply of drinking-water check the prevalence of typhoid-fever, in another place similar measures show no such influence; or, again, in one city the introduction of a good system of sewerage diminishes epidemic diseases, and in another no similar result follows. We should therefore aim to secure, as far as possible, good sanitary arrangements in all directions and in all respects.

It has also been rendered evident, in what has been said, that infectious agents differ markedly from each other in their behavior; so that, while public sanitation aims at those measures which are found to be most widely beneficial, it should not forget that each infectious disease is as much a separate problem in its prophylaxis as in its symptomatology, etiology, and treatment. It will not aim to combat cholera with the means found best adapted to scarlet-fever, but it will adapt preventive measures as directly to the specific end in view as possible. In presenting to you the results of researches chiefly bacteriological concerning the scientific basis of preventive medicine, I hope to escape the accusation of one-sidedness and narrowness by the statement that I do not for a moment intend to imply that the bacteriological method is our only source of accurate knowledge on the subjects which have been considered. My aim is accomplished if I have succeeded in making clear that this method has established facts which aid in a clearer conception of the causes of some important infectious diseases, in a better understanding of the sources and dangers of infection, and in a more efficient selection and application of sanitary measures.

If this science of only a few years' growth has furnished already acquisitions to knowledge so important, so far reaching, may we not look forward with assurance to the solution of many dark problems in the domain of infectious diseases, — problems the solution of which may yield to preventive medicine a future of usefulness and success which we cannot now foresee?

LUCERNE OR ALFALFA.

DURING the past two years considerable has been written concerning the value of alfalfa as a forage-plant and for hay. Experiments in a limited way have been made at the Agricultural Station at Geneva, N.Y., of which Mr. Peter Collier is the director, since 1882.

Alfalfa or lucerne is botanically the same plant (*Medicago sativa*, Lin.), and one of the clover or leguminous family. Alfalfa has been grown in Greece for nearly three thousand years as a forage-plant. The Romans esteemed it very highly, and Columella writes that it yielded four to six crops a year. In France the plant is known as lucerne, and in Spain as alfalfa. It is grown quite extensively in southern Europe. From Spain alfalfa was introduced into South America, and thence by way of Mexico to California, where it still retains the Spanish name, alfalfa. While in California and many of the Western and Southern States it is grown quite extensively, it has never been much cultivated in the Northern States. In the Eastern States it was introduced from Europe, and is generally known as lucerne. The alfalfa from California is said to withstand drought far better than the lucerne of Europe, while the lucerne withstands cold winters better than the alfalfa.

It seems to be the prevalent opinion that lucerne does not flourish well so far north as New York State, but seven years' experience with it at the Geneva station proves that it can and will thrive well in this latitude. Chancellor Livingstone experimented with it with good results on his estate in Columbia County nearly ninety years ago. It has been generally conceded, that, in order to succeed, lucerne must have a deep, sandy, or light loam soil. The experience of the station has been upon heavy clay loam, some of it of a cold retentive nature. This indicates that alfalfa will thrive well upon other than sandy or light loamy soils. Two acres and a half of lucerne now growing at the station, on three parts of the farm, show well the capabilities of the plant to withstand the drought and northern winters. In 1882 two plats were put down to lucerne and alfalfa. These plats have yielded several crops each season since. In 1888 they were cut three times, and yielded an average

of about fifteen tons per acre of green fodder, after having been down to grass from the original seeding six years.

From the analysis of alfalfa for different years as grown at the station, at the period of full bloom it was found to contain 67.46 per cent of water. With the figures of the analysis as the basis, it is found, that if the fifteen tons of green fodder, having a composition like the above, were converted into hay, they would be equal to 5.6 tons of hay per acre. The chemical composition of this hay is shown by analysis to be much like red-clover hay, and to contain nearly as much albuminoids as does wheat-bran. The total amount of fertilizing matter removed from one acre by the crop for the year was very large. Especially is this true of the nitrogen, potash, and lime. Alfalfa is pre-eminently a lime-loving plant, and it is generally recommended to apply a good dressing of lime to the soil before putting down to alfalfa.

In a feeding trial made at the station during the past winter, the digestibility of alfalfa hay was determined. The subject for experimentation was a four-year-old Jersey cow, in milk about two months when the trial was made. Feb. 23 the feeding of alfalfa hay was begun. Twenty-five pounds per day were offered, and, during the five days on which the dung was saved, an average of 24.31 pounds, or 389 ounces, per day were eaten. The amount of dry matter consumed per day was 322.7 ounces.

By comparison of the results with those for the digestibility of clover hay as found by Armsby, it is found that alfalfa is considerably more digestible than red clover. Especially is this true for the albuminoids and nitrogen-free extract.

Some notes from station experience, on the method of preparing the soil for planting out lucerne-seed and for curing the hay, may be of interest to those who contemplate making a trial of this crop.

Perhaps the best time to sow alfalfa is in the spring. The earliness will depend on the condition of the soil, moisture, and warmth. A crop that is to hold the ground, so long as we expect alfalfa to produce profitably, should have a faultless seed-bed prepared for it to start on. This is especially desirable where the first year's growth may be expected to be small, and may be overcome by weeds if any exist with it, and care is not taken to reduce them to a minimum. It would be well to specially prepare a suitable piece of land with a late summer fallow, or some crop which can be kept hoed free from weeds. Then, when the land is in good condition to work in spring, make a nice bed, and, if there is likelihood of many weeds starting on it, wait a week for them to germinate, harrow up well, and at once sow the alfalfa-seed if it is to be broadcasted. If it is to be drilled and cultivated the first season, the harrowing before seeding may be omitted. Roll the soil with a moderately heavy roller after sowing the seed. This will compact the soil about the seed, and hasten germination.

Having the crop started, one has only to watch the growth, and, if vigorous enough, it may be cut the first season. If allowed to stand too long, alfalfa becomes hard and woody in the stalk: hence a part will be wasted. It will also draw too largely from the roots for the good of the succeeding crops: so it seems best to cut it during the first period of good weather after the blossoms begin to appear. If designed for soiling, it should be wilted before feeding, to be sure that animals will not eat enough to cause hoven. This can be done by cutting feed one day ahead in fair weather, or longer if there is an appearance of storm.

If designed for hay, it must be very carefully handled, for like all the clovers, and to a greater extent perhaps, its leaves will drop off during the curing and housing, and leave only a mass of bare stalks instead of the bright green leaves and blue blossoms which ought to stay on for the best hay.

A good time to mow is in the afternoon, so it will wilt but not dry much before night. The next forenoon or toward evening, after the leaves become tough, pitch together into small cocks from the machine-swath.

Two active men can pitch from three to five swaths together quite fast, and, if wide barley-straw forks are used, there will be little use for a rake. After the cocks are made, they should stand two or three days before pitching over; then put two or three into one, if making well, and observe to turn every forkful bottom up, and spread out the thick green bunches so they will be brought into contact with the dry portions. All the work of pitching, from the first to the final mowing away, must be done when the alfalfa is tough, but not wet from dew in the morning or evening. Never handle clover when it rattles, for the leaves will be broken and wasted. A second or third handling will be needed before the hay will be fit to store. The drawing should be done early in the forenoon; and, if the bottom layers of hay are wet, the cocks can be overturned from the sun, and, after a few minutes' exposure, will be dry enough to load. Alfalfa or other clover hay made in this way comes out fresh and bright, and retains its leaves and flowers to an extent beyond the belief of those who are accustomed to rake clover with a horse, open out the hay to the sun, and pitch it in the heat of the day. The value saved will be worth all the extra time, if any is required.

The result of the station experience with lucerne or alfalfa may be summarized as follows: 1. That lucerne or alfalfa may be successfully grown in New York State; 2. That when once established, it thrives well upon clay land, but will probably do better upon good light loam; 3. That seed two years old loses its vitality, and fails to germinate (undoubtedly many of the failures to secure a stand of plants may be traced to poor seed); 4. That the seed-bed must be well prepared, and in this latitude it seems best to plant out the seed in the spring, and with no other crop (the seed should be but lightly covered by rolling the ground); 5. That for seven successive years at the station three and four cuttings per year have been taken from the plats; 6. That last year, the sixth in succession, the plats yielded more than fifteen tons per acre of green forage, equal to 5.6 tons of alfalfa hay; 7. That alfalfa should be cut in early bloom, before the plants become woody; 8. That it should be cured largely in the cock to produce the best quality of hay; 9. That by chemical analysis the hay was found to be more nitrogenous than good red clover; 10. That cattle, sheep, and horses all relished the hay, and seemed to do well; 11. That it was found to be more digestible than red-clover hay; 12. That if farmers would try this crop, it is advisable to begin with a small piece of well-prepared land, in order to see whether alfalfa does as well with them as it has at the station; 13. That probably success with alfalfa will depend largely upon having fresh seed, a good, carefully prepared seed-bed, and in covering the seed lightly with soil.

HEALTH MATTERS.

PNEUMONIA. — Drs. C. W. Townsend and A. Coolidge, jun., of Boston, from a study, published in *The Medical News*, of all the cases of lobar pneumonia treated at the Massachusetts General Hospital, from the first case, in 1822, up to the present day, find that (1) in the thousand cases of this disease treated between those dates there was a mortality of 25 per cent; (2) the mortality has gradually increased from 10 per cent in the first decade, to 28 per cent in the present decade; (3) this increase is deceptive for the following reasons, all of which were shown to be a cause of a large mortality, — (*a*) the average age of the patients has been increasing from the first to the last decade, (*b*) the relative number of complicated and delicate cases has increased, (*c*) the relative number of intemperate cases has increased, (*d*) the relative number of foreigners has increased; (4) these causes are sufficient to explain the entire rise in the mortality; (5) treatment which was heroic before 1850, transitional between 1850 and 1860, and expectant and sustaining since 1860, has not, therefore, influenced the mortality rate; (6) treatment has not influenced the duration of the disease or of its convalescence. It must, however, be admitted that the present treatment of expectancy — a treatment which makes the patient as comfortable as possible, preserves his strength, and avoids every thing harsh — is certainly far more agreeable to the patient than the former heroic method. After these studies, we cannot but admire the regular and uniform manner in which pneumonia — that type of self-limited diseases — has run its course in all these years, uninfluenced by the varying treatment it has received.

DR. BROWN-SEQUARD'S HYPODERMIC FLUID. — The extraordinary statements made by Professor Brown-Séquard as to the efficiency of hypodermic injections of fluid expressed from certain tissues of young animals in senile debility have been to a certain